To Whom it May Concern:

Advanced Fibre Communications, Inc. is a Telecommunications Equipment manufacturer based in Petaluma California. We supply Multi-Service Access Platforms, the newest generation to evolve from Digital Loop Carrier, to a variety of carriers throughout the US and the world. The following discussion is a response to the Public Notice DA 99-2985 of the FCC entitled "COMMON CARRIER BUREAU SEEKS COMMENT ON REQUESTS TO REDEFINE "VOICE GRADE ACCESS" FOR PURPOSES OF FEDERAL UNIVERSAL SERVICE SUPPORT"
The following is a request-by-request discussion of the questions in DA 99-2985.

"We seek comment, in particular, on the technical issues involved in modifying that requirement. Although bandwidth affects the speed at which modems operate, modem performance is a function of several factors, only one of which is bandwidth. In that regard, we invite commenters to identify factors other than bandwidth that affect modem performance in rural and non-rural areas."

The factors affecting modem data rate are, of course, independent of rural or non-rural application. These are enumerated below:

- Non-linear Distortion (NLD.) This can be in the form of quantization distortion introduced by mu-Law CODECs in the link between the Internet Service Provider (ISP) and the customer. This can also be in the form of transformer or semiconductor physical properties which introduce NLD. It can also come about by overloading amplifiers to the point of clipping. By far the most common NLD is CODEC quantization caused by successive transfer of a signal between analog and digital networks. This factor cannot be compensated for by either the customer or the ISP MODEM. It is the fundamental reason that only 56 k-bps will ever be achieved from an 8-bit, 8 k-Hz CODEC.
- Impedance Mismatch and ensuing Echo. These are factors that the MODEM manufacturers have as one of their highest cost factors to overcome. A higher cost modem can reduce the effects of echo. The echoes are introduced at both the carrier's line card and at the customer's modem. The characteristic impedance of cable is not well matched either to the 600 Ohms of the MODEM or to the 600 or 900 Ohms of the line card serving the cable. The other echo mechanism is bridged taps on the customer line. These are more predominant in older loop plant since the newer carrier serving area model in place in many administrations reduces the need to bridge. With the carrier plan, wire is run only for a customer that is in place and is not bridged from existing wire runs where unused cable pairs already go to another distant customer location. In the trade-off between cost, market demand and the statistics of local loops the public sector has already determined the extent to which a customer will pay for higher data rate in the face of this factor. It is the price of a commercially available MODEM.
- Noise. This is from sources such as power-line-induced, resistive, amplifier electronics or cross talk. In any event, only an increased transmission level of the MODEM signal will overcome such noise ingress. In the limit, increases in the MODEM signal level will result in the cross-talk in the wire bundle becoming predominant; and a signal-to-noise limit is reached because of the physical constants of any given cable design. Resistive, induced, cosmic and any other sources are completely out of the realm of the MODEM's capability to eliminate. This factor relates to the

FCC's rule with respect to average level and is evidence that that level should be permitted to increase. Such increase is trivial compared to the levels and cross-talk capability of such signals as ISDN and various DSL types.

o Frequency Response. This factor is a simple limitation in signal energy. The fewer spectral components that reach the destination, the less is the possible information transfer rate. This is the one factor that can most be compensated for by the MODEM, and that is at relatively low cost.

o Group Delay. This is an effect that makes the individual spectral components arrive at the destination at differing arrival times despite the fact that any bit is transmitted at a single instant. It is due to the physics of transmission line theory and is exactly analogous to the phenomenon that splits the different lines of the spectrum of white light into its components by a prism. This effect is also relatively easy to compensate in the MODEM and is still much easier than echo compensation, although it is related to echo compensation.

o Channel Associated Signaling, Robbed Bit (CAS-RB.) This is a factor that simply increases non-linear distortion. In the American system of T-Carrier transport, one out of 6 voice signal words has its least significant encoded bit usurped by the multiplexor system to transmit to the far end the signaling state of the line (on-hook, ringing, etc.) This reduces the available data rate by at least 1333.33 bps for every such bit-robbing. The bit is not "replaced" at the far end it is merely forced to a "1" regardless of what it was intended to be by the speaker's voice (or the MODEM.) Fortunately, this can be predicted and thus minimized by some modern ISP MODEM server and customer MODEM systems which fully implement the ITU-T V.90 specification. Unfortunately, however, every pass through an exchange, local or long distance, has the potential of robbing one of the other 5 non-robbed samples thereby degrading the signal until all 6 samples have had their LSB used for this signaling function. Clearly, limitation of the number of exchanges cannot be enforced. Only widespread dissemination of Common-Channel-Signaling (CCS) methods such as SS7 or the European CAS-CC will alleviate this.

o Time and Frequency Jitter. This impairment is one in which the carrier frequency warbles up and down by some percentage. This is so well controlled by modern crystal-controlled timing systems that we have never seen this to be a factor. There are some old Radio Carrier systems that can exhibit significant jitter. The physics of Satellite communications also can introduce such jitter but these systems typically have such good compensation for jitter that it is not a problem in Satellite systems.

We also request that commenters provide detailed and technical information with respect to how any such change would affect carriers' eligibility to receive universal service support.

This change is related to the customer's NI. The electronic equipment at the carrier could be made to respond over any arbitrarily large frequency range while the worst case customer, separated by 20,000 to 100,000 feet of cable from that equipment must receive the now proposed more stringently regulated signal. As support eligibility depends on the performance at the customer's location, the carrier would have to install more and more complex equipment to achieve that performance. There are already loop compensation

equipments in various forms to achieve the current performance requirement. Due to the physical nature of the cable, there is an exponential cost point as 4000 Hz is approached. This is the reason that the loading coil methodology was adopted and the 8 k-Hz sample rate was chosen so many years ago under the auspices of the telephone company of that day. Unlike modern PC technology, the wire in the ground is not cost-effective to replace and the 4 k-Hz limit is insurmountable. The carrier would be caught between physics and regulation and universal service support would be jeopardized.

We seek comment on how to ensure that consumers and carriers in rural areas are not adversely affected if the Commission modifies the voice grade bandwidth requirement and if, as a result, certain rural carriers become ineligible to receive universal service support.

The rural carrier will be most hard-hit by the proposed rule change and thus most likely to lose subsidy. The physics of the cable plant are most adverse to the long loops encountered in higher percentages in the rural jurisdictions. The cost and time to upgrade would be highest in these rural areas and the first wave of new high-cost mechanism rules, aimed at the more aggressive re-invention of the network, would not be available to help the rural carrier whereas it would help the urban/suburban carrier who needs it the least.

Commenters should also explain how an expanded definition of voice grade access for purposes of universal service support would affect the new high-cost universal service mechanism that will be implemented for non-rural carriers on January 1, 2000.

This would be "gold-plating" as the commission calls it. An effort to make existing infrastructure perform better at its old job rather than moving forward with new technology that will replace that older infrastructure. The point of the rule change is to offer digital services; whereas new technologies are making digital services more and more independent of old telephony plant by operating completely outside of the original voice band.

We ask commenters to discuss the need for and implications of "hold harmless" provisions under such circumstances.

"Hold harmless", therefore, is even more urgent in the presence of this rule change. The cost of the basic level of service is increased. New technology to implement this change is not a leap to lower cost via a new communications mechanism, it is rather an increment to existing know-how. The ramifications for the future are, in this case, only higher cost and not new technology development.

Finally, we seek comment on the financial impact that expanding the

Commission's definition of voice grade access to support faster voiceband data transmission would have on individual carriers.

The financial impact would be moot if the support mechanisms take into account the impact of the rule change, but gathering data as the basis for such a change would take longer than the data rate issue will be a relevant problem given the advancement of DSL.

Commenters should address whether an increase in the bandwidth required for voice grade access may have the unintended effect of encouraging substantial investment in the public switched telephone network to enhance analog modem performance to the possible detriment of investment in high speed, switched broadband networks

To increment the VF POTS performance requirements again at this stage would require re-targeting of engineering resources from advanced DSL product developments. The Telecommunications industry, in general, is suffering from a severe shortage of engineers. The proposed rule change will most decidedly slow down the advancement of DSL and other carrier-based Internet access technologies while increasing the cost of the existing infrastructure without achieving strategic technological gain.

We ask commenters to identify other technical parameters that the Commission might adopt, in addition to possible changes to the voice grade access requirements, to improve rural consumers' access to the Internet and other information services.

The technical parameters identified above are so overlapping and can be so traded in the achievement of any data rate that we believe that there is no fair way to regulate these parameters. The goal of achieving a data rate is far beyond that of achieving voice perception quality. To specify a "guaranteed" data rate beyond 4800 bps is a denial of the facts of the physics of the existing wires, components, technology and economics. If time, legislation and money are spent for provision of data access using the existing PSTN at this time such expenditure would be discarded within 5 years and would come at the expense of technological advancement. This seems contrary to the apparent focus of the FCC's rules and intent.

In the event that data connectivity remains a part of the FCC's bailiwick, it is the opinion of AFC that only the data rate be regulated and that it be left to the marketplace to decide the mechanism for data rate assurance. This is ill advised, however, since the data rate must be testable between a known point in the digital network close to the customer in the LEC's network using a "known-good" MODEM server. The guarantee of an end user data rate, however, is problematic at best unless the Internet Service Providers also come under regulation. Furthermore, since the data rate is also a consequence of every network element between the customer and the ISP and since the ISP and the customer are not generally within the same LEC; investigation and enforcement become very difficult. Regulation of the parameters between the LEC and the customer is easier to investigate and enforce but will not guarantee data access rates no matter how stringently

they are drawn.

Commenters are encouraged to provide detailed comment on these as well as any additional issues raised by the petitions and proposals to modify the Commission's current voice grade access bandwidth requirement.

The purpose of the Federal Communications Commission and of the various states' Commissions in this subject as we view it is to provide for public safety and to regulate monopolistically characterized providers of public communications utilities. The ability to make a telephone call for emergency services is a matter of public safety. The provision of data services was formerly a matter of monopolistically characterized businesses in control of these services. Today, by the admission of the Commissions own words in the High-Host Methods Further Notice of Proposed Rulemaking, the access is competitive. This leaves voice service for the purpose of public safety as the only real need for regulation.

The title of the rule contains "Voice Grade Access" not "Internet Grade Access" as its object. It is the position of Advanced Fibre Communications, Inc. that the rule not be adopted.